US009200633B2

(12) **United States Patent**
Yamada et al.

(10) **Patent No.: US 9,200,633 B2**
(45) **Date of Patent: Dec. 1, 2015**

(54) **SCROLL COMPRESSOR WITH OLDHAM RING HAVING SCROLL-SIDE KEYS AND BEARING-SIDE KEYS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 177 days.

(21) Appl. No.: **13/579,767**

(22) PCT Filed: **Nov. 16, 2011**

(86) PCT No.: **PCT/JP2011/006378**
§ 371 (c)(1),
(2), (4) Date: **Aug. 17, 2012**

(87) PCT Pub. No.: **WO2012/101696**
PCT Pub. Date: **Aug. 2, 2012**

(65) **Prior Publication Data**

US 2012/0308422 A1 Dec. 6, 2012

(30) **Foreign Application Priority Data**

Jan. 26, 2011 (JP) 2011-013610
Apr. 20, 2011 (JP) 2011-093755
Apr. 20, 2011 (JP) 2011-093756

(51) **Int. Cl.**
F01C 17/06 (2006.01)
F01C 1/02 (2006.01)
F04C 2/02 (2006.01)
F04C 18/02 (2006.01)
F01C 21/10 (2006.01)

(52) **U.S. Cl.**
CPC ***F04C 18/0207*** (2013.01); ***F01C 17/066*** (2013.01); ***F01C 21/10*** (2013.01); ***F04C 18/0253*** (2013.01)

(58) **Field of Classification Search**
CPC . F01C 17/066; F04C 18/0207; F04C 18/0253
USPC 418/55.3, 55.1; 464/102, 104, 105
See application file for complete search history.

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(57) **ABSTRACT**

A scroll compressor is characterized in that by reducing an Oldham ring **57** and an orbiting scroll **12** in size, a compressing mechanism **4** is reduced in size, a pair of scroll-side keys **57***b* are disposed at locations deviated from each other from a diameter line of the ring portion **57***a* so that a distance between the pair of scroll-side keys **57***b* becomes not less than a width of the scroll-side keyway **12***d*, and a pair of main bearing-side keys **57***c* are disposed at locations deviated from each other from the diameter line of the ring portion **57***a* so that a distance between the pair of main bearing-side keys **57***c* becomes not less than a width of the main bearing-side keyways **51***a*.

7 Claims, 11 Drawing Sheets

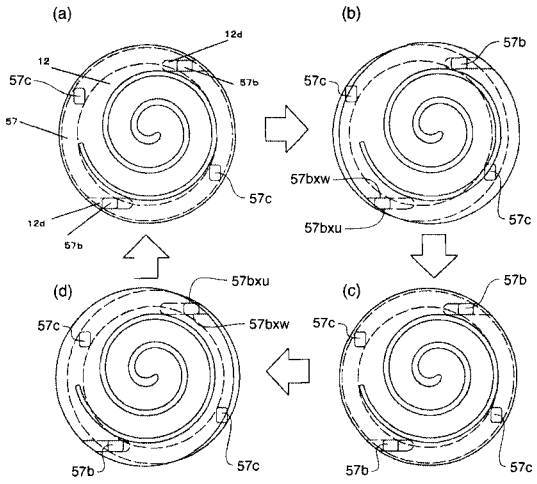

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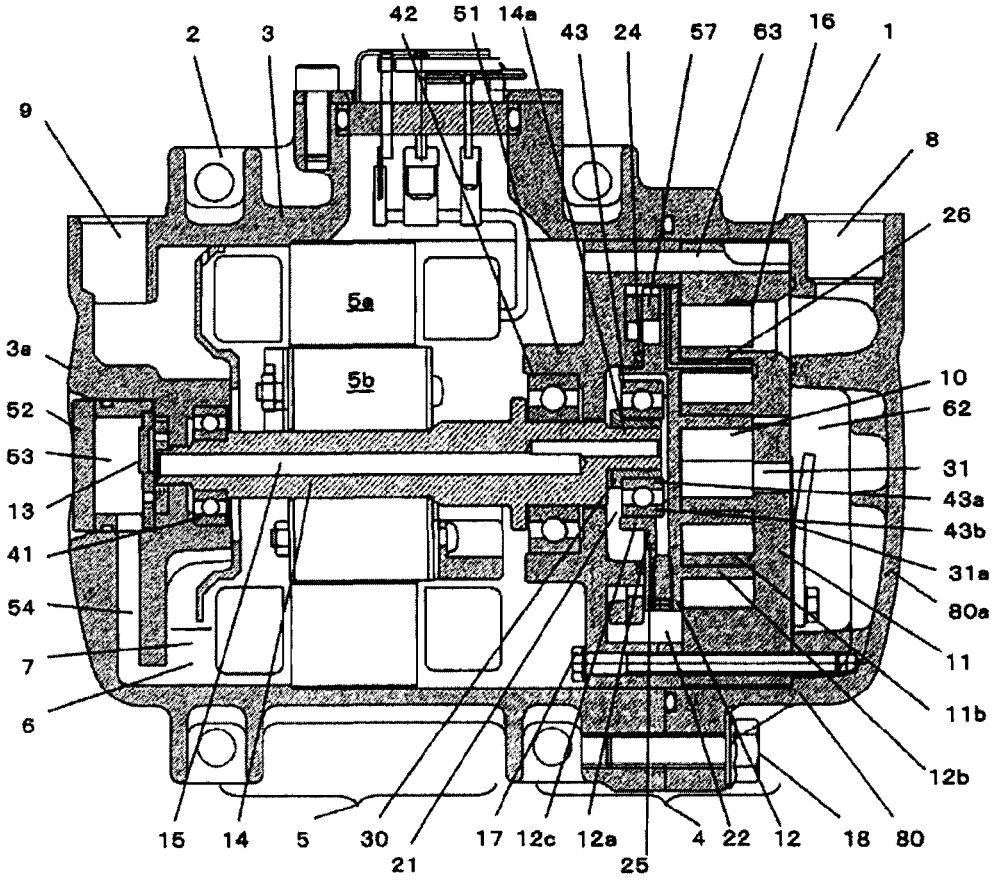
Fig. 1


2
3
42
51
14a
43
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57
63
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9
8
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5a
5b
3a
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13
41
54
7
6
10
62
31
43a
43b
31a
80a
11
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12c
12a
25
4
22
12
18
80

Fig. 2

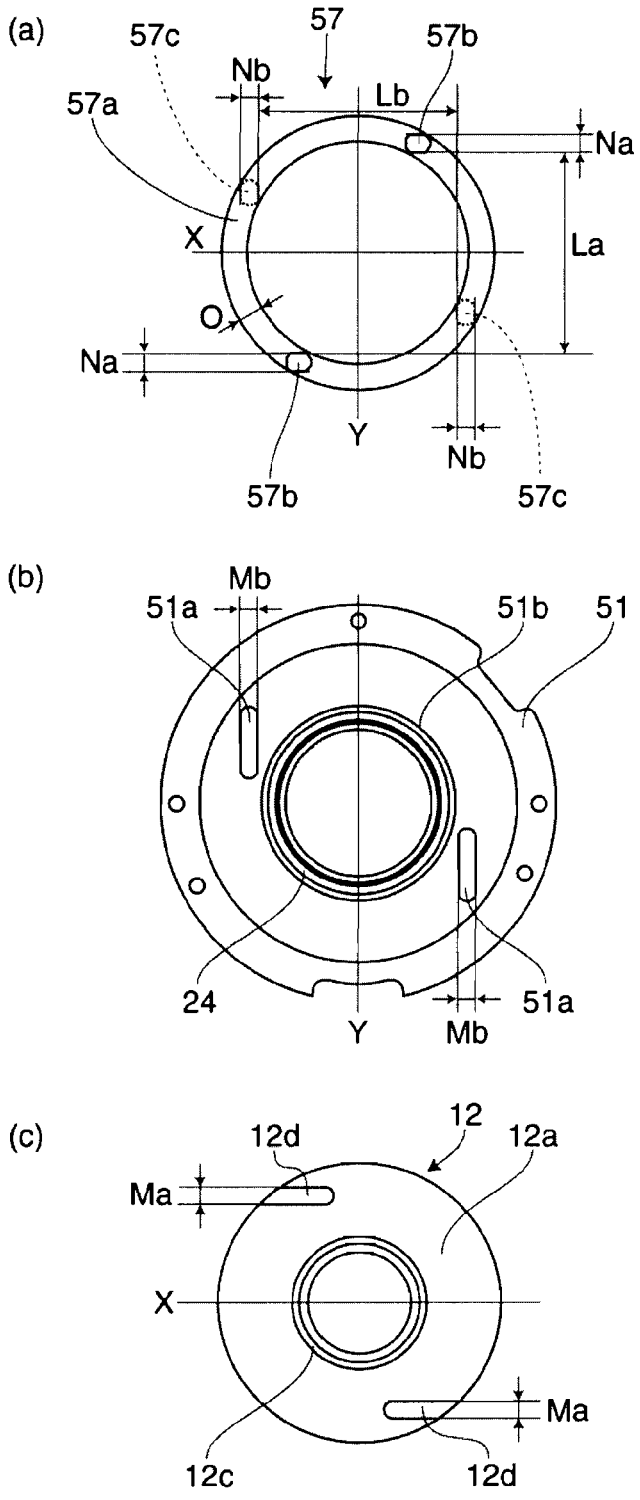

(a)
57c
57
57b
Nb
Lb
57a
Na
X
La
O
Na
Y
Nb
57b
57c
(b)
Mb
51a
51b
51
24
Y
Mb
51a
(c)
12d
12
12a
Ma
X
Ma
12c
12d

Fig. 3

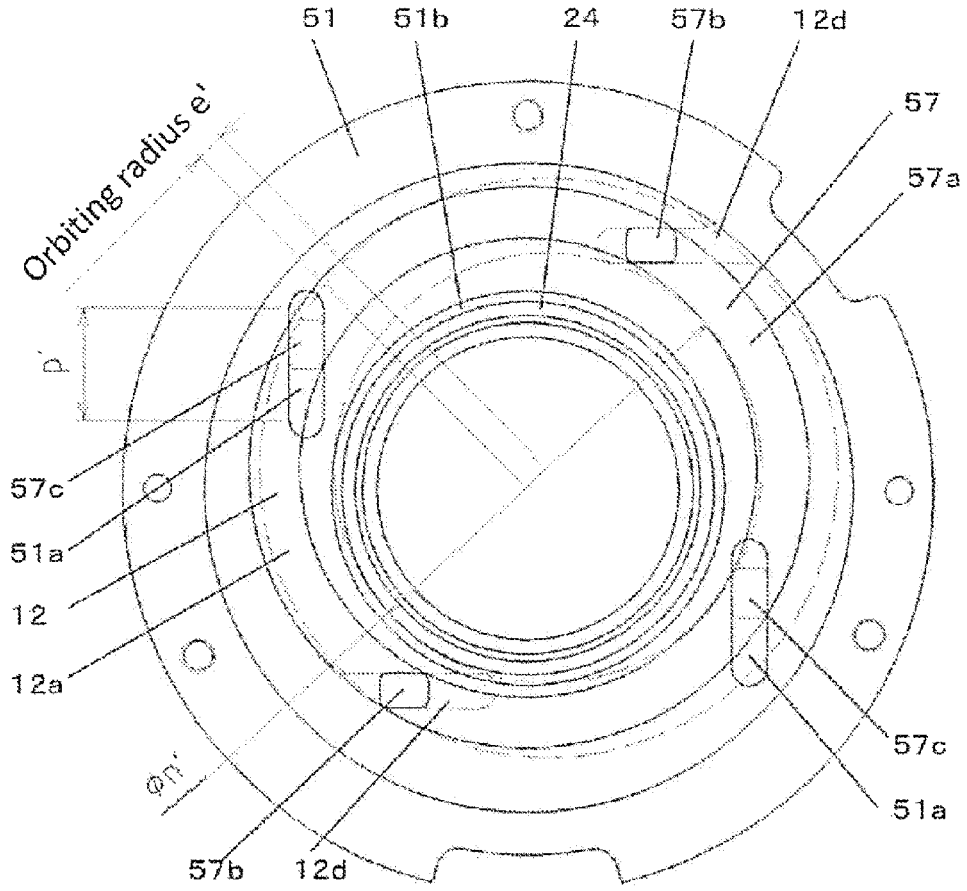
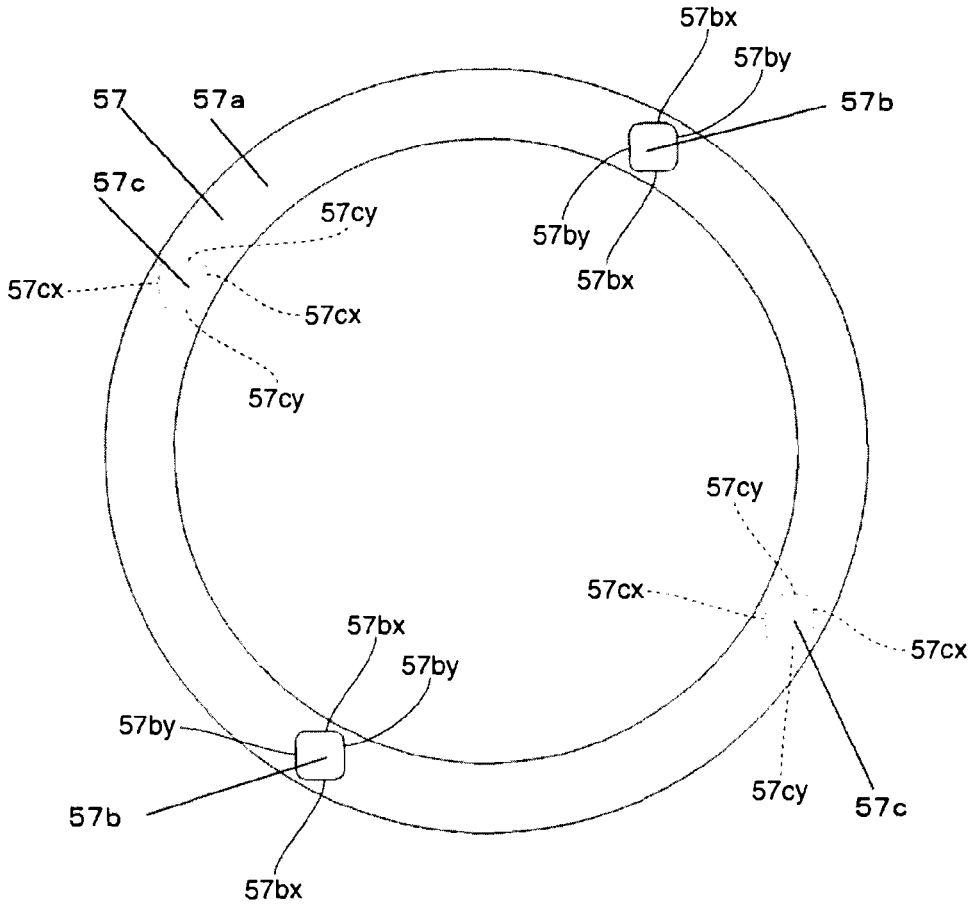

51
51b
24
57b
12d
57
57a
Orbiting radius e'
57c
51a
12
12a
57c
51a
57b
12d

Fig. 4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57cy
57c

Fig. 5

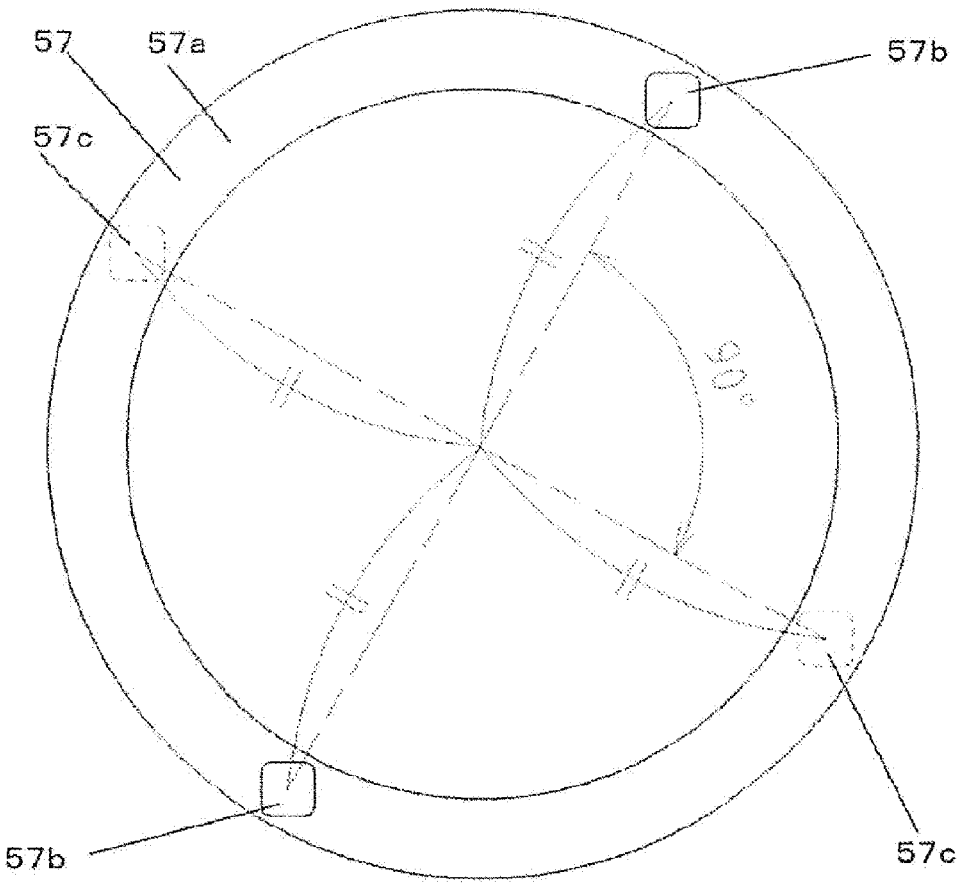
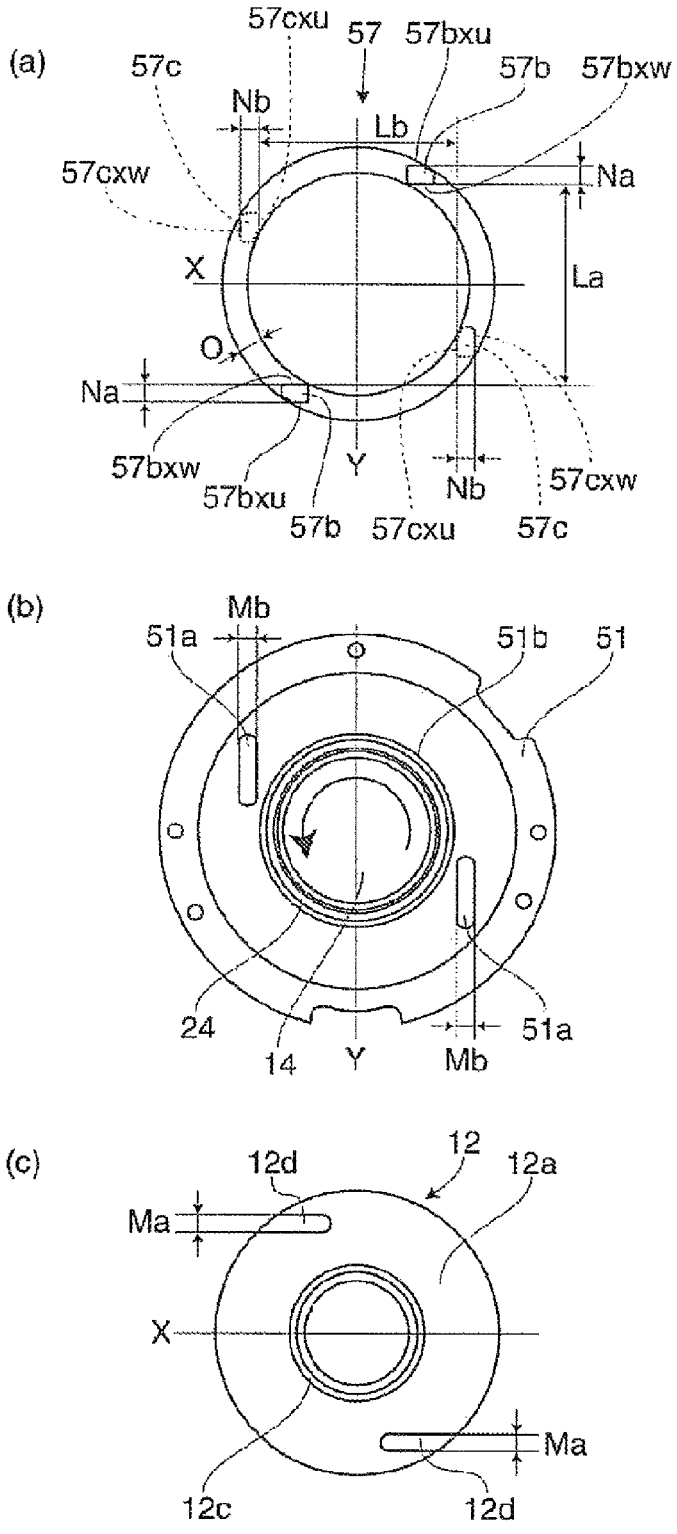


Fig. 6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57
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Nb
Lb
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O
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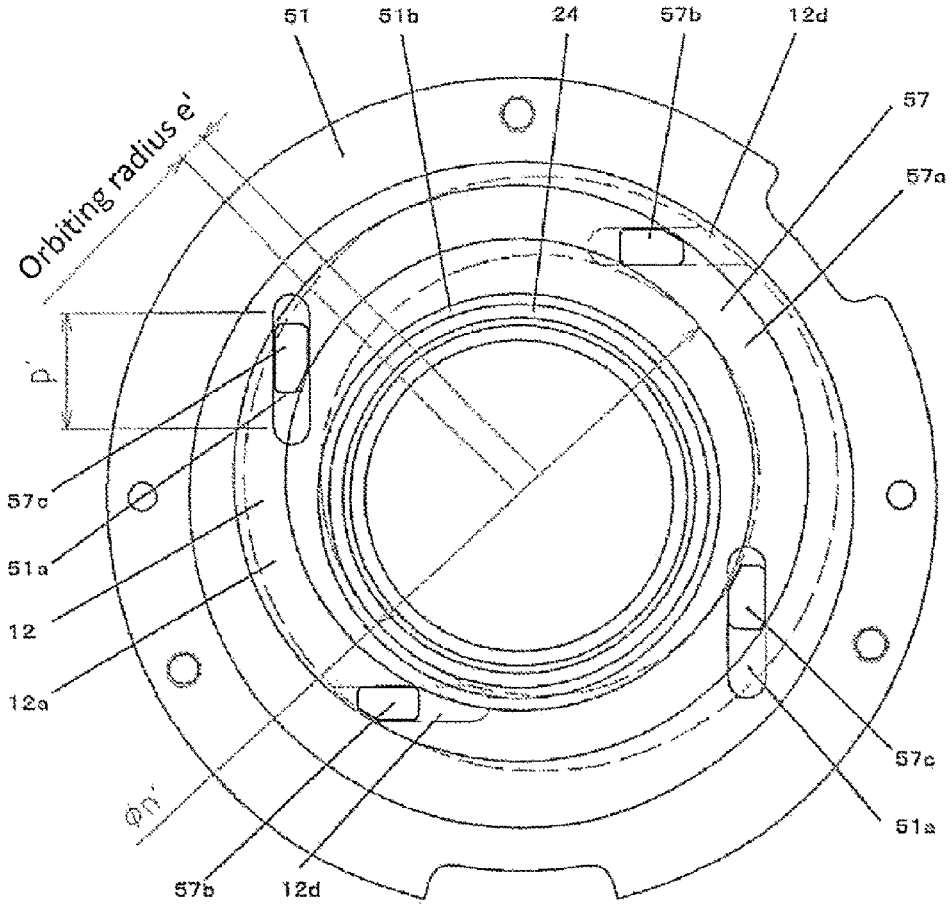
57bxu
Y
Nb
57cxw
57b
57cxu
57c
(b)
Mb
51a
51b
51
24
14
Y
Mb
51a
(c)
12d
12
12a
Ma
X
Ma
12c
12d

Fig. 7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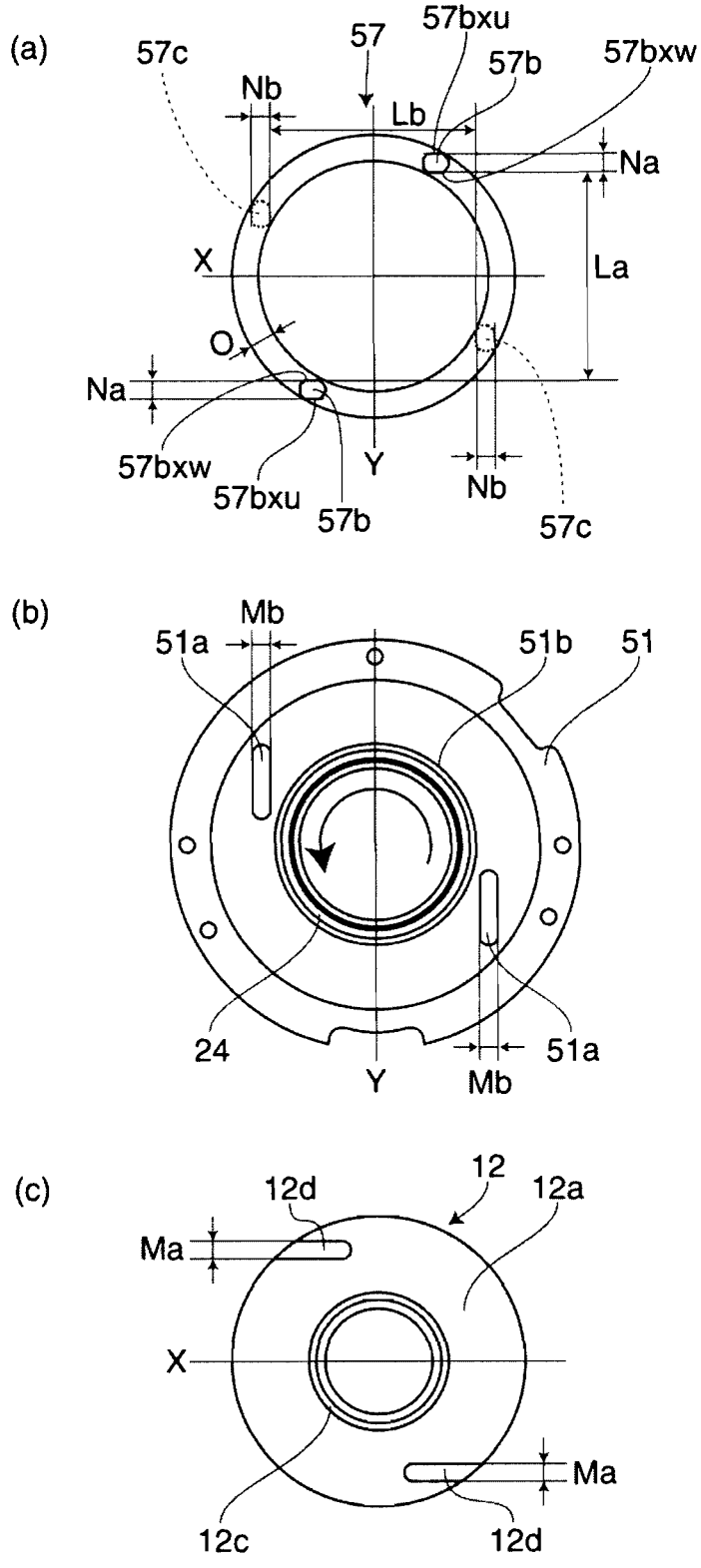
51b
24
57b
12d
57
57a
Orbiting radius e'
p'
57c
51a
12
12a
57c
51a
θr'
57b
12d

Fig. 8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57b
57bxw
Nb
Lb
Na
X
La
O
Na
57bxw
57bxu
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Y
Nb
57c
(b)
Mb
51a
51b
51
24
Y
Mb
51a
(c)
12d
12
12a
Ma
X
Ma
12c
12d

Fig. 9

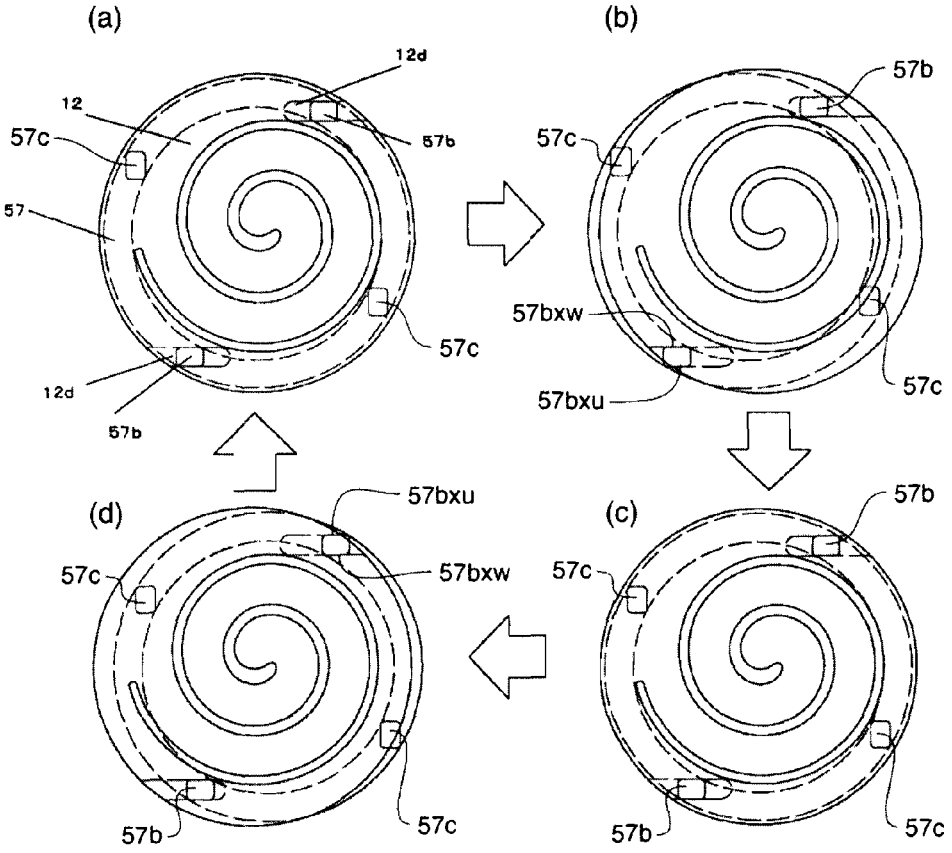
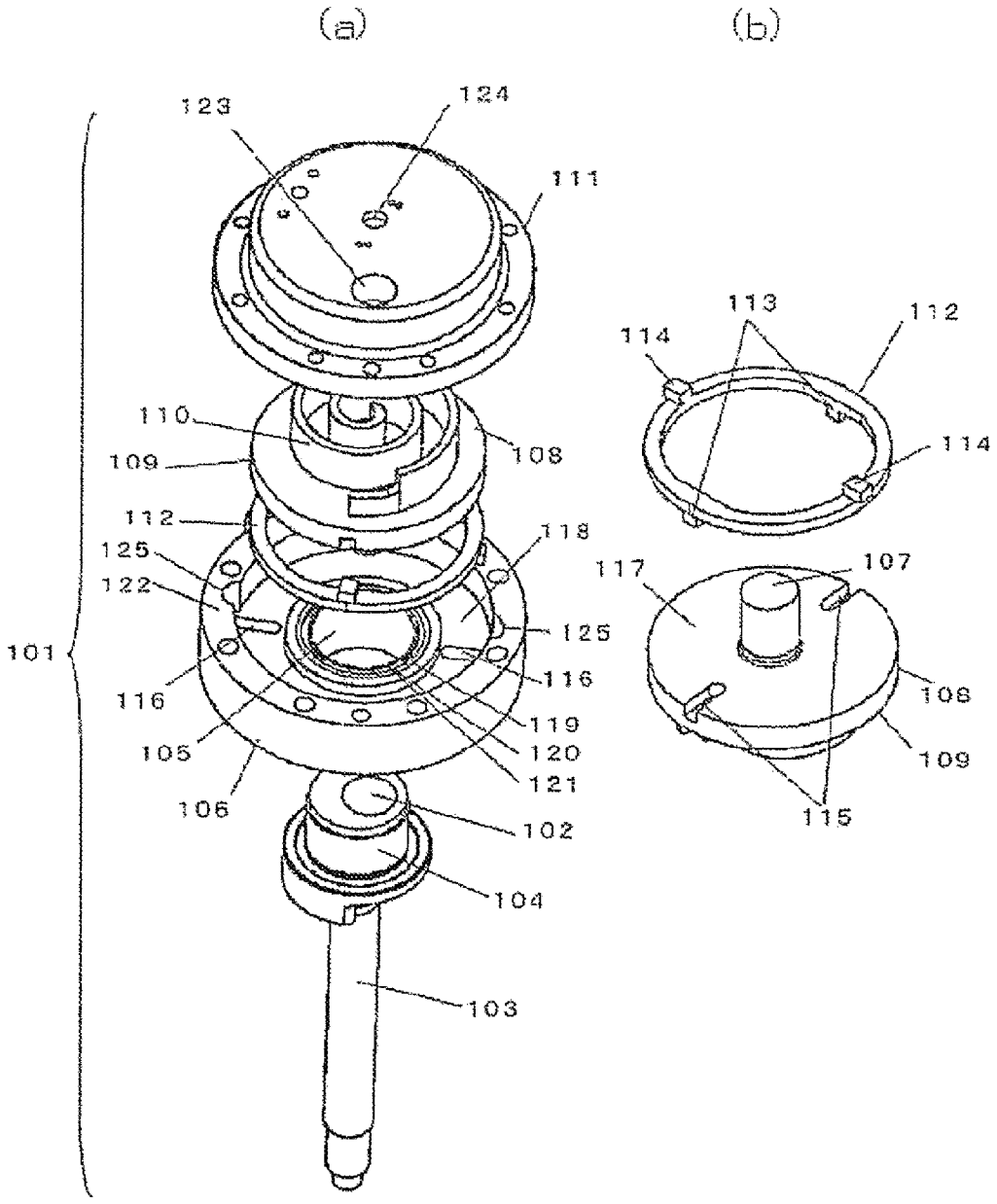

(a)
12d
12
57c
57b
57
57c
12d
57b
(b)
57b
57c
57bxw
57bxu
57c
(c)
57b
57c
57b
57c
(d)
57bxu
57c
57bxw
57b
57c

Fig. 10


(a)
(b)
123
124
111
110
109
108
112
125
122
118
125
116
116
119
120
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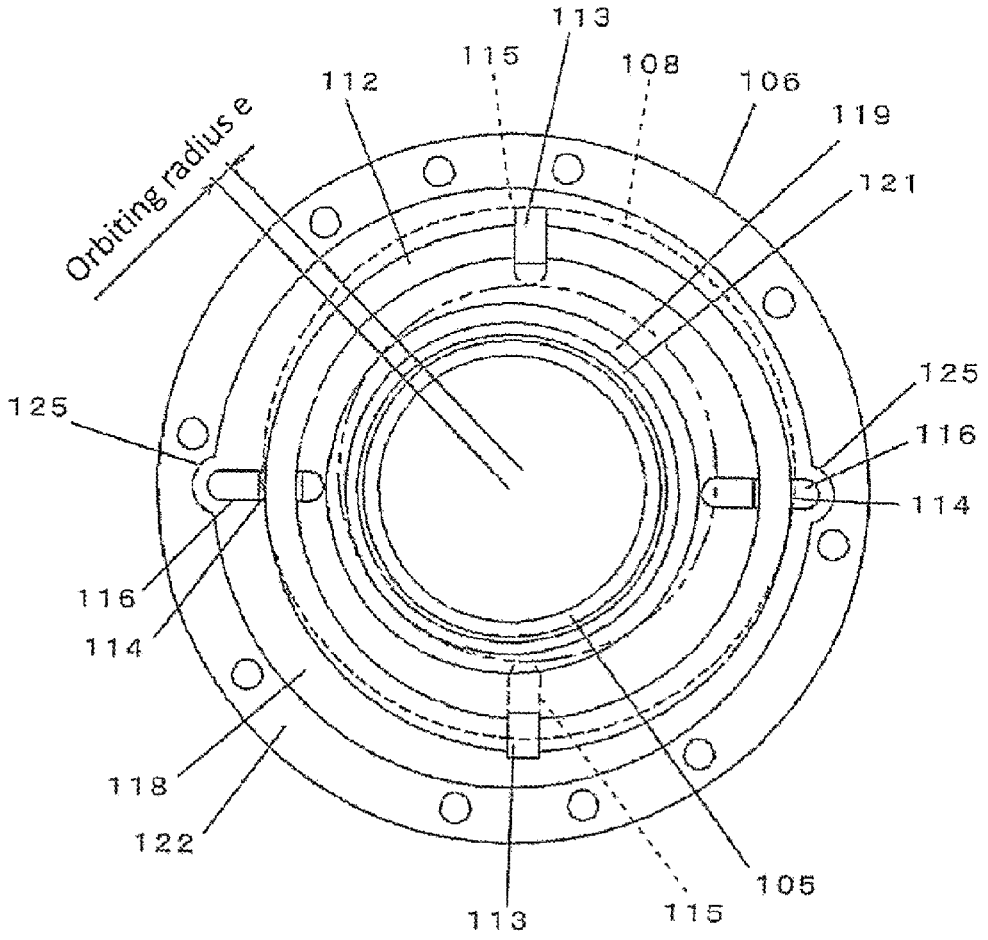
102
104
103
101
113
112
114
114
117
107
108
109
115

Fig. 11


113
115
108
106
112
119
Orbiting radius e
121
125
125
116
114
116
114
118
122
105
113
115

SCROLL COMPRESSOR WITH OLDHAM RING HAVING SCROLL-SIDE KEYS AND BEARING-SIDE KEYS

TECHNICAL FIELD

The present invention relates to a scroll compressor using a rotation-preventing mechanism for orbiting a driven member such that the driven member does not rotate when a rotation force of a driving member is transmitted to the driven member.

BACKGROUND TECHNIQUE

Conventionally, an Oldham ring is widely used for a scroll compressor as one of rotation-preventing mechanisms for orbiting a driven member such that the driven member does not rotate when a rotation force of a driving member is transmitted to the driven member.

A conventional scroll compressor using the Oldham ring which is one of the rotation-preventing mechanisms will be described with reference to drawings (see patent document 1 for example). FIG. **10**(*a*) is an exploded perspective view of a compressing mechanism of a conventional scroll compressor as viewed from a fixed scroll. FIG. **10**(*b*) is an exploded perspective view of an orbiting scroll and an Oldham ring of the conventional scroll compressor as viewed from their back surfaces. FIG. **11** is a plan view of a bearing member and the Oldham ring of the scroll compressor shown in FIG. **10** as viewed from a back surface of the bearing member **106**.

FIG. **11** shows, by dotted lines, an orbiting panel **108** of the orbiting scroll **109** and a keyway **115**. An envelope circle in which an outer diameter of a seal member **121** disposed in the bearing member **106** is in contact with a back surface **117** of the orbiting panel **108** is shown by a phantom line.

In FIGS. **10**(*a*) and **10**(*b*), the compressing mechanism **101** includes a crankshaft **103**, the bearing member **106**, the orbiting scroll **109**, the fixed scroll **111** and the Oldham ring **112**.

The crankshaft **103** includes an eccentric shaft **102**. The bearing member **106** includes a main bearing **105** which rotatably supports a main shaft **104** of the crankshaft **103**. The orbiting scroll **109** includes a driving shaft **107** which is rotatably fitted into the eccentric shaft **102**, the driving shaft **107** is provided on the orbiting panel **108**, and an orbiting scroll blade **110** is provided on the orbiting panel **108** on a side opposite from the driving shaft **107**. The fixed scroll **111** includes a fixed scroll blade (not shown) which meshes with the orbiting scroll blade **110** of the orbiting scroll **109** to form a plurality of compression spaces. An outer periphery **122** of the bearing member **106** and the fixed scroll **111** which is in contact with the outer periphery **122** are fixed to each other through a plurality of bolts.

A pair of scroll-side keys **113** are provided on one of surfaces of the Oldham ring **112**, and a pair of bearing-side keys **114** are provided on the other surface of the Oldham ring **112**.

A pair of scroll-side keyways **115** with which the scroll-side keys **113** slide are provided on the back surface **117** of the orbiting panel **108** of the orbiting scroll. **109** on its diameter line.

Bearing-side keyways **116** on which the bearing-side keys **114** slide are provided in a back surface **118** of the bearing member **106** on its diameter line.

A sliding direction of the scroll-side keys **113** the scroll-side keyways **115** and a sliding direction of the bearing-side keys **114** in the bearing-side keyways **116** intersect with each other at right angles.

A thrust support **119** which supports the orbiting panel **108** in a thrust direction is provided on the back surface **118** of the bearing member **106**. An annular groove **120** is provided in the thrust support **119**. The seal member **121** is provided on the annular groove **120**. Different pressures are applied to an inner side and an outer side of the seal member **121**, and when the compressor is operated, the orbiting scroll **109** is biased toward the fixed scroll **111** under an optimal force.

Rotation of the crankshaft **103** is transmitted to the driving shaft **107** of the orbiting scroll **109**. The orbiting scroll **109** is moved in a first direction which is restricted by the scroll-side keys **113** and the scroll-side keyways **115**, and in a second direction which is restricted by the bearing-side keys **114** and the bearing-side keyways **116**, and rotation of the orbiting scroll **109** is inhibited. Since the first direction and the second direction intersect with each other at right angles, movement in the first direction and movement in the second direction are combined with each other, and the orbiting scroll **109** orbits with an orbiting radius e. As the orbiting scroll **109** orbits, the seal member **121** moves with the orbiting radius a with its surface which is in contact with the orbiting panel **108**. A diameter of an envelope circle of the seal member **121** at its contact surface is a value of an outer diameter of the seal member **121** to which twice of the orbiting radius e is added.

According to the above-described configuration, if a rotation force from a motor (not shown) is transmitted from the crankshaft **103** to the orbiting scroll **109**, the plurality of compression spaces formed between the orbiting scroll **109** and the fixed scroll **111** move from an outer peripheral side toward an inner peripheral side and with this movement, fluid is compressed. Therefore, fluid sucked from a suction port **123** of the compressing mechanism **101** is compressed and discharged from a discharge port **124**.

PRIOR ART DOCUMENT

Patent Document

[Patent Document 1] Japanese Patent Application Laid-open No. 2000-213474

SUMMARY OF THE INVENTION

Problem to be Solved by the Invention

According to the conventional configuration, however, since the pair of scroll-side keys **113** and the pair of bearing-side keys **114** of the Oldham ring **112** are disposed on a short axis and a long axis of the ring portion such that the keys **113** and the keys **114** intersect with each other at right angles, there are problems that there is a limit to reduce a diameter of the ring portion and the ring portion and an inner diameter of the bearing member **106** interfere with each other. Further, since the scroll-side keys **113** and the bearing-side keys **114** project from an outer diameter of the ring portion, there is a problem that it is necessary to provide a release portion **125** for avoiding the interference with the inner diameter of the bearing member **106**.

The present invention has been accomplished to solve the conventional problems, and it is an object of the invention to provide a scroll compressor in which the compressing mechanism is reduced in size by reducing the Oldham ring and the orbiting scroll in size.

Means for Solving the Problems

A first aspect of the present invention provides a scroll compressor comprising a compressing mechanism, in which

the compressing mechanism comprises a crankshaft including an eccentric shaft, a main bearing member which rotatably supports the crankshaft, an orbiting scroll which is rotatably fitted to the eccentric shaft, a fixed scroll which meshes with the orbiting scroll to form a compression space, and an Oldham ring which prevents the orbiting scroll from rotating, the Oldham ring comprises a ring-shaped ring portion, a pair of scroll-side keys provided on one of surfaces of the ring portion, and a pair of main bearing-side keys provided on the other surface of the ring portion, the orbiting scroll is provided with scroll-side keyways with which the scroll-side keys slide, the main bearing member is provided with main bearing-side keyways with which the main bearing-side keys slide, a sliding direction of the scroll-side keys in the scroll-side keyways and a sliding direction of the main bearing-side keys in the main bearing-side keyways intersect with each other at right angles, wherein the pair of scroll-side keys are disposed at locations deviated from each other from a diameter line of the ring portion so that a distance between the pair of scroll-side keys becomes equal to or greater than a width of the scroll-side keyway, and the pair of main bearing-side keys are disposed at locations deviated from each other from the diameter line of the ring portion so that a distance between the pair of main bearing-side keys becomes equal to or greater than a width of the main bearing-side keyway.

According to a second aspect, in the scroll compressor of the first aspect, the scroll-side key and the main bearing-side key do not project from an outer diameter of the ring portion, and do not project from an inner diameter of the ring portion.

According to a third aspect, in the scroll compressor of the first or second aspect, sliding surfaces which are side surfaces of the pair of scroll-side keys and which slide with the scroll-side keyways, and sliding surfaces which are side surfaces of the pair of the main bearing-side keys and which slide with the main bearing-side keyways include load-side sliding surfaces which receive loads depending upon a rotation direction of the crankshaft, and non-load-side sliding surfaces which do not receive loads depending upon the rotation direction of the crankshaft, and an area of the non-load-side sliding surface is smaller than an area of the load-side sliding surface.

According to a fourth aspect, in the scroll compressor of the third aspect, the area of the non-load-side sliding surface is not less than half of the area of the load-side sliding surface.

According to a fifth aspect, in the scroll compressor of the first or second aspect, sliding surfaces which are side surfaces of the pair of scroll-side keys and which slide with the scroll-side keyways include load-side sliding surfaces which receives loads depending upon a rotation direction of the crankshaft and non-load-side sliding surfaces which do not receive loads depending upon the rotation direction of the crankshaft, and the non-load-side sliding surface projects outward from the scroll-side keyway, and the load-side sliding surface does not project outward from the scroll-side keyway.

According to a sixth aspect, in the scroll compressor of the fifth aspect, a projecting area of the non-load-side sliding surface projecting outward from the scroll-side keyway is not more than half of an entire area of the load-side sliding surface.

According to a seventh aspect, in the scroll compressor of the first aspect, the pair of scroll-side keys and the pair of main bearing-side keys are formed by individual molding, and they are assembled and fixed to the ring portion.

According to an eighth aspect, in the scroll compressor of the first aspect, side surfaces of the pair of scroll-side keys and/or side surfaces of the pair of main bearing-side keys include sliding surfaces which slide with the scroll-side keyways and/or the main bearing-side keyways, and non-sliding surfaces which do not slide with the scroll-side keyways and/or the main bearing-side keyways, and the sliding surfaces and the non-sliding surfaces have the same shapes.

According to a ninth aspect, in the scroll compressor of the eighth aspect, a line segment which connects centers of the pair of scroll-side keys with each other and a line segment which connects centers of the pair of main bearing-side keys intersect with each other at right angles at a center of the ring portion.

Effect of the Invention

According to the scroll compressor of the invention, since the outer diameter of the Oldham ring and the outer diameter of the orbiting scroll can be reduced, the compressing mechanism can be reduced in size, and it is possible to design the compressing mechanism having an increased orbiting radius.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view of a scroll compressor according to a first embodiment of the present invention;

FIG. **2**(*a*) is a plan view of an Oldham ring of the scroll compressor of the first embodiment as viewed from a fixed scroll, FIG. **2**(*b*) is a plan view of a main bearing member of the scroll compressor of the first embodiment as viewed from the fixed scroll, and FIG. **2**(*c*) is a plan view of an orbiting scroll of the scroll compressor of the first embodiment as viewed from a back surface of a panel;

FIG. **3** is a plan view of a combination of the Oldham ring and the main bearing member of the first embodiment as viewed from the fixed scroll;

FIG. **4** is a plan view of an Oldham ring of a second embodiment of the invention;

FIG. **5** is a plan view of an Oldham ring of a third embodiment of the invention;

FIG. **6**(*a*) is a plan view of an Oldham ring of a scroll compressor of a fourth embodiment as viewed from a fixed scroll, FIG. **6**(*b*) is a plan view of a main bearing member of the scroll compressor of the fourth embodiment as viewed from the fixed scroll, and FIG. **6**(*c*) is a plan view of an orbiting scroll of the scroll compressor of the fourth embodiment as viewed from a back surface of a panel;

FIG. **7** is a plan view of a combination of the Oldham ring and the main bearing member of the fourth embodiment as viewed from the fixed scroll;

FIG. **8**(*a*) is a plan view of an Oldham ring of a scroll compressor of a fifth embodiment as viewed from a fixed scroll, FIG. **8**(*b*) is a plan view of a main bearing member of the scroll compressor of the fifth embodiment as viewed from the fixed scroll, and FIG. **8**(*c*) is a plan view of an orbiting scroll of the scroll compressor of the fifth embodiment as viewed from a back surface of a panel;

FIGS. **9**(*a*) to **9**(*d*) are sectional views of essential portions of a combination of the Oldham ring and the orbiting scroll of the fifth embodiment as viewed from the fixed scroll,

FIG. **10**(*a*) is an exploded perspective view of a compressing mechanism of a conventional scroll compressor as viewed from a fixed scroll, and FIG. **10**(*b*) is an exploded perspective view of an orbiting scroll and an Oldham ring of the conventional scroll compressor as viewed from a back surface, and

FIG. **11** is a plan view of a bearing member and the Oldham ring of the scroll compressor shown in FIG. **10** as viewed from the back surface of the bearing member.

EXPLANATION OF SYMBOLS

4 compressing mechanism
5 motor

7 lubricant oil
11 fixed scroll
12 orbiting scroll
12*a* panel
12*c* cylindrical portion
12*d* scroll-side keyway
14 crankshaft
14*a* eccentric shaft
51 main bearing member
51*a* main bearing-side keyway
57 Oldham ring
57*a* ring portion
57*b* scroll-side key
57*c* main bearing-side key
57*bxw*, **57***cxw* load-side sliding surface
57*bxu*, **57***cxu* non-load-side sliding surface

MODE FOR CARRYING OUT THE INVENTION

According to the first aspect, the pair of scroll-side keys are disposed at locations deviated from each other from a diameter line of the ring portion so that a distance between the pair of scroll-side keys becomes equal to or greater than a width of the scroll-side keyway, and the pair of main bearing-side keys are disposed at locations deviated from each other from the diameter line of the ring portion so that a distance between the pair of main bearing-side keys becomes equal to or greater than a width of the main bearing-side keyway. According to this, an outer diameter of the ring portion can be made small and hence, the compressing mechanism can be made compact, and it is possible to design the compressing mechanism such that an orbiting radius is further increased in size.

According to the second aspect, in the first aspect, the scroll-side key and the main bearing-side key do not project from an outer diameter of the ring portion, and do not project from an inner diameter of the ring portion. Therefore, it is unnecessary to provide a release portion in the vicinity of the keyway of the main bearing member for avoiding interference with respect to the key provided in the ring portion. A shape in the vicinity of the key of a mold which manufactures a raw material of the Oldham ring is simplified and thus, a life span of the mold is increased, and a lathe can be used for machining inner and outer peripheral surfaces of the ring portion. Therefore, productivity is enhanced, strengths of root portions of the keys are enhanced and reliability is enhanced.

According to the third aspect, in the first or second aspect, sliding surfaces which are side surfaces of the pair of scroll-side keys and which slide with the scroll-side keyways, and sliding surfaces which are side surfaces of the pair of the main bearing-side keys and which slide with the main bearing-side keyways include load-side sliding surfaces which receive loads depending upon a rotation direction of the crankshaft, and non-load-side sliding surfaces which do not receive loads depending upon the rotation direction of the crankshaft, and an area of the non-load-side sliding surface is smaller than an area of the load-side sliding surface. Therefore, since the width of the ring portion of the Oldham ring can be made small and the outer diameter of the Oldham ring can be made small, it is possible to reduce the compressing mechanism in size, and it is possible to design the compressing mechanism such that the orbiting radius is further increased in size.

According to the fourth aspect, in the third aspect, the area of the non-load-side sliding surface is not less than half of the area of the load-side sliding surface. Therefore, even in an unstable operation state immediately after start of operation, or in a transitory state or when the compressor is at rest, the compressor can be operated stably and the reliability is enhanced.

According to the fifth aspect, in the first or second aspect, sliding surfaces which are side surfaces of the pair of scroll-side keys and which slide with the scroll-side keyways include load-side sliding surfaces which receives loads depending upon a rotation direction of the crankshaft and non-load-side sliding surfaces which do not receive loads depending upon the rotation direction of the crankshaft, and the non-load-side sliding surface projects outward from the scroll-side keyway, and the load-side sliding surface does not project outward from the scroll-side keyway. Therefore, the outer diameter of the Oldham ring can be made small, and since the non-load-side sliding surfaces of the pair of keys on the one surface side project toward the outer diameter of the orbiting scroll, the outer diameter of the orbiting scroll can be correspondingly reduced in size by the projecting amount. Hence, the compressing mechanism can be made compact, and it is possible to design the compressing mechanism such that the orbiting radius is increased in size.

According to the sixth aspect, in the fifth aspect, a projecting area of the non-load-side sliding surface projecting outward from the scroll-side keyway is rot more than half of an entire area of the load-side sliding surface. Since the areas of the non-load-side sliding surfaces are not less than halves of the areas of the load-side sliding surfaces, even in an unstable operation state immediately after start of operation, or in a transitory state or when the compressor is at rest, the compressor can be operated stably and the reliability is enhanced.

According to the seventh aspect, in the first aspect, the pair of scroll-side keys and the pair of main bearing-side keys are formed by individual molding, and they are assembled and fixed to the ring portion. If light and inexpensive material is employed for the ring portion, it is possible to reduce the scroll compressor in weight and cost, and if material having excellent sliding performance is employed, the reliability is enhanced.

According to the eighth aspect, in the first aspect, side surfaces of the pair of scroll-side keys and/or side surfaces of the pair of main bearing-side keys include sliding surfaces which slide with the scroll-side keyways and/or the main bearing-side keyways, and non-sliding surfaces which do not slide with the scroll-side keyways and/or the main bearing-side keyways, and the sliding surfaces and the non-sliding surfaces have the same shapes. Therefore, it becomes easy to machine the surface on the side of the key, the productivity is enhanced, and since there is no directional property of the side surface of the key, errors when assembling with the ring portion are eliminated and the productivity is enhanced.

According to the ninth aspect, in the eighth aspect, a line segment which connects centers of the pair of scroll-side keys with each other and a line segment which connects centers of the pair of main bearing-side keys intersect with each other at right angles at a center of the ring portion. Since front and back of the rotation-preventing mechanism are the same, assembling error are eliminated and the productivity is enhanced.

Embodiments of the present invention will be described with reference to the drawings below. The invention is not limited to the embodiments.

FIRST EMBODIMENT

FIG. **1** is a sectional view of a scroll compressor according to a first embodiment of the present invention. FIG. **2**(*a*) is a plan view of an Oldham ring of the scroll compressor of the

first embodiment as viewed from a fixed scroll. FIG. **2**(*b*) is a plan view of a main bearing member of the scroll compressor of the first embodiment as viewed from the fixed scroll. FIG. **2**(*c*) is a plan view of an orbiting scroll of the scroll compressor of the first embodiment as viewed from a back surface of a panel.

FIG. **3** is a plan view of a combination of the Oldham ring and the main bearing member of the first embodiment as viewed from the fixed scroll, and a panel of the orbiting scroll and keyways are shown by dotted lines. An envelope circle in which a seal member disposed on a main bearing member is in contact with the back surface of the panel is shown by a phantom line.

FIG. **1** shows a horizontal scroll compressor **1** which is horizontally installed by means of mounting legs **2** provided around a barrel of the scroll compressor **1**.

The scroll compressor **1** includes a body casing **3**. A compressing mechanism **4** and a motor **5** which drives the compressing mechanism **4** are incorporated in the body casing **3**. The scroll compressor **1** also includes a liquid reservoir **6** in which liquid for lubricating various sliding portions including the compressing mechanism **4** is stored. The motor **5** is driven by a motor driving circuit (not shown). Fluid handled here is a refrigerant, and liquid such as lubricant oil **7** is employed as liquid for lubricating the various sliding portions and for sealing sliding portions of the compressing mechanism **4**. It is preferable that the lubricant oil **7** has compatibility with the refrigerant, however, the present invention is not limited to this. Basically, the invention is not limited to the embodiment only if the scroll compressor **1** includes the body casing **3** in which the compressing mechanism **4** which sucks, compresses and discharges the refrigerant, the motor **5** which drives the compressing mechanism **4**, and the liquid reservoir **6** in which liquid for lubricating the sliding portions including the compressing mechanism **4** are incorporated, and the motor **5** is driven by the motor driving circuit.

The compressing mechanism **4** includes a crankshaft **14**, a main bearing member **51**, an orbiting scroll **12**, a fixed scroll **11** and an Oldham ring **57**. The crankshaft **14** includes an eccentric shaft **14***a*. The main bearing member **51** rotatably supports the crankshaft **14**. The orbiting scroll **12** is rotatably fitted over the eccentric shaft **14***a*. The fixed scroll **11** meshes with the orbiting scroll **12** to form a compression space **10**. The Oldham ring **57** prevents the orbiting scroll **12** from rotating, and orbits the orbiting scroll **12**.

The compressing mechanism **4** orbits the orbiting scroll **12** with respect to the fixed scroll **11**, thereby moving the compression space **10**, a volume thereof is varied, a refrigerant is sucked into the compression space **10**, and after the refrigerant is compressed, it is discharged from the compression space **10**.

The compression space **10** is formed by meshing a spiral lap **11***b* of the fixed scroll **11** and a spiral lap **12***b* of the orbiting scroll **12** with each other. The orbiting scroll **12** orbits by rotation of the crankshaft **14**. The crankshaft **14** is rotated by the motor **5**.

A refrigerant which returns from an external cycle is sucked tram a suction port **8** provided in a sub-casing **80**, and is discharged into the external cycle from a discharge port **9** provided in the body casing **3**.

The lubricant oil **7** stored in the liquid reservoir **6** is introduced into a crankshaft oil-supply passage **15** of the crankshaft **14** by driving a pump **13** using the crankshaft **14**, or by utilizing a pressure difference in the body casing **3**. The lubricant oil **7** which is introduced into the crankshaft oil-supply passage **15** is supplied to a high pressure region **21** formed on a back surface of a panel **12***a* of the orbiting scroll **12** by orbiting driving of the orbiting scroll **12**.

A seal member **24** is disposed on the back surface of the panel. **12***a*. An inner side of the seal member **24** is a high pressure region **21**, and an outer side of the seal member **24** is a back pressure chamber **22**. That is, the high pressure region **21** and the back pressure chamber **22** are partitioned from each other by the seal member **24**.

The orbiting scroll **12** is provided therein with a back pressure chamber oil-supply passage **25** which is connected to the back pressure chamber **22** from the high pressure region **21**, and a compression chamber oil-supply passage **26** which is connected to the compression space **10** from the back pressure chamber **22**.

One open end of the back pressure chamber oil-supply passage **25** reciprocates through the seal member **24**, a portion of the lubricant oil **7** supplied to the high pressure region **21** lubricates an eccentric rolling bearing **43** and then is supplied to the back pressure chamber **22**. By supplying the portion of the lubricant oil **7** to the back pressure chamber **22**, a back pressure is applied to the orbiting scroll **12**. The lubricant oil **7** supplied to the back pressure chamber **22** by the compression chamber oil-supply passage **26** is supplied to the compression space **10**, and the lubricant oil **7** seals and lubricates between the fixed scroll **11** and the orbiting scroll **12**. Another portion of the lubricant oil **7** which is supplied to the high pressure region **21** lubricates a main rolling bearing **42** and then flows out toward the motor **5** and it is collected into the liquid reservoir **6**.

The pump **13**, an auxiliary rolling bearing **41**, the motor **5**, and a main bearing member **51** having a main rolling bearing **42** are disposed in the body casing **3** in this order from a side of an end wall **3***a*. The pump **13** is accommodated from an outer surface of the end wall **3***a* and then, the pump **13** is fitted to the end wall **3***a* by a lid **52**. Therefore, the pump **13** is hold between the end wall **3***a* and the lid **52**.

A pump chamber **53** is formed inside of the lid **52**. The pump chamber **53** includes a pumping passage **54** which is in communication with the liquid reservoir **6**. The auxiliary rolling bearing **41** is supported by the end wall **3***a*, and supports an end of the crankshaft **14** which is connected to the pump **13**.

The motor **5** rotates the crankshaft **14** by a stator **5***a* and a rotor **5***b*. The stator **5***a* is fixed to an inner periphery of the body casing **3** by shrink fitting. The rotor **5***b* is fixed to an intermediate portion of the crankshaft **14**.

The main bearing member **51** is fixed to an inner periphery of the sub-casing **80** through a bolt **17**, and supports an end of the crankshaft **14** on the side of the compressing mechanism **4** through the main rolling bearing **42**. The fixed scroll **11** is mounted on an outer peripheral surface of the main bearing member **51** through a bolt (not shown). The orbiting scroll **12** is sandwiched between the main bearing member **51** and the fixed scroll **11**. The orbiting scroll **12** and the fixed scroll **11** are opposed to each other. The Oldham ring **57** is provided between the main bearing member **51** and the orbiting scroll **12**. The Oldham ring **57** prevents the orbiting scroll **12** from rotating, and makes the orbiting scroll **12** orbit.

The eccentric shaft **14***a* is integrally formed on an end of the crankshaft **14**. A bushing **30** is fitted over and supported by the eccentric shaft **14***a*. The orbiting scroll **12** is supported by the bushing **30** through the eccentric rolling bearing **43** such that the orbiting scroll **12** can orbit. A cylindrical portion **12***c* projects from the back surface of the panel **12***a* of the orbiting scroll **12**, and the eccentric rolling bearing **43** is accommodated in the cylindrical portion **12***c*. An inner race **43***a* of the eccentric rolling bearing **43** is fitted over the bushing **30**, and

an outer race **43***b* of the eccentric rolling bearing **43** is loosely fitted into the cylindrical portion **12***c* with a slight gap therebetween.

A portion of the compressing mechanism **4** that is exposed from the sub-casing **80** is covered with the body casing **3**. An opening of the sub-casing **80** and an opening of the body casing **3** are butted against each other and they are fixed to each other through a bolt **18**. An end wall **80***a* is formed on a side opposite from the end wall **3***a*.

The compressing mechanism **4** is located between the suction port **8** of the sub-casing **80** and the discharge port **9** of the body casing **3**. The discharge port **9** is provided between the motor **5** and the end wall **3***a*. The compressing mechanism **4** includes a suction port **16** and a discharge port **31**. The suction port **16** is in communication with the suction port **8** of the sub-casing **80**. The discharge port **31** is provided with a reed valve **31***a*. A discharge chamber **62** is provided between the discharge port **31** and the end wall **80***a*. If the reed valve **31***a* opens, the discharge port **31** and the discharge chamber **62** are brought into communication with each other. The discharge chamber **62** is in communication with a space around the motor **5** through a communication passage **63**. The discharge port **9** is in communication with the space around the motor **5**. The communication passage **63** is formed between the fixed scroll **11** and the body casing **3**, and between the main bearing member **51** and the body casing **3**.

By the above-described configuration, the scroll compressor **1** moves as follows.

The motor **5** is driven by the motor driving circuit to rotate the crankshaft **14**. The crankshaft **14** makes the compressing mechanism **4** orbit, and drives the pump **13**. The pump **13** supplies lubricant oil **7** in the liquid reservoir **6** to the compressing mechanism **4**. The lubricant oil **7** lubricates the compressing mechanism **4**, and seals the compressing mechanism **4**.

A refrigerant which returns from the refrigeration cycle is sucked into the compression space **10** from the suction port **8** of the sub-casing **80** and from the suction port **16** provided in the fixed scroll **11**, the refrigerant is compressed and then is discharged from the discharge port **31** into the discharge chamber **62**. A refrigerant which is discharged into the discharge chamber **62** enters the space around the motor **5** through the communication passage **63**, cools the motor **5** and is discharged from the discharge port **9**. While the refrigerant discharged into the discharge chamber **62** is discharged from the discharge port **9**, lubricant oil **7** is separated from the refrigerant by the action of collision and squeezing. The auxiliary rolling bearing **41** is lubricated by the lubricant oil **7** which is mixed in the refrigerant.

As shown in FIG. **2**(*a*), the Oldham ring **57** includes a ring portion **57***a* which is formed into an O-ring shape having a constant width, a pair of scroll-side keys **57***b* provided on one of surfaces of the ring portion **57***a*, and a pair of main bearing-side keys **57***c* provided on the other surface of the ring portion **57***a*.

As shown in FIG. **2**(*b*), main bearing-side keyways **51***a* with which the main bearing-side keys **57***c* slide are provided in the back surface of the main bearing member **51**. The main bearing-side keys **57***c* are slidably fitted into the main bearing-side keyways **51***a*.

As shown in FIG. **2**(*c*), scroll-side keyways **12***d* with which the scroll-side keys **57***b* slide are provided in the back surface of the panel **12***a* of the orbiting scroll **12**. The scroll-side keys **57***b* are slidably fitted into the scroll-side keyways **12***d*.

A sliding direction of the scroll-side keys **57***b* in the scroll-side keyways **12***d* and a sliding direction of the main bearing-side keys **57***c* in the main bearing-side keyways **51***a* intersect with each other at right angles.

The pair of scroll-side keys **57***b* are disposed at locations deviated from each other from a diameter line X of the ring portion **57***a*. A distance La between the pair of scroll-side keys **57***b* is not less than a width Ma of the scroll-side keyway **12***d* or not less than a width Na of the scroll-side key **57***b*.

The pair of main bearing-side keys **57***c* are disposed at locations deviated from each other from a diameter line Y of the ring portion **57***a*. A distance Lb between the pair of main bearing-side keys **57***c* is not less than a width Mb of the main bearing-side keyway **51***a* or not less than a width Nb of the main bearing-side key **57***c*.

The scroll-side keys **57***b* and the main bearing-side keys **57***c* are disposed such that they do not project from an outer diameter of the ring portion **57***a* and they do not project from an inner diameter of the ring portion **57***a*. Therefore, it is unnecessary to provide a release portion in the vicinity of the main bearing-side keyway **51***a* of the main bearing member **51** for avoiding interference with respect to the main bearing-side key **57***c*. A shape in the vicinity of the key of a mold which manufactures a raw material of the Oldham ring **57** is simplified and thus, a life span of the mold is increased, and a lathe can be used for machining inner and outer peripheral surfaces of the ring portion **57***a*. Therefore, productivity is enhanced, strengths of root portions of the scroll-side keys **57***b* and the main bearing-side keys **57***c* are enhanced and reliability is enhanced.

Rotation of the crankshaft **14** is transmitted to the cylindrical portion **12***c* of the orbiting scroll **12**. The orbiting scroll **12** moves in a first direction which is restricted by the scroll-side keys **57***b* and the scroll-side keyways **12***d*, and in a second direction which is restricted by the main bearing-side keys **57***c* and the main bearing-side keyways **51***a*, and the orbiting scroll **12** is prevented from rotating. Since the first direction and the second direction intersect with each other at right angles, movement in the first direction and movement in the second direction are combined with each other, and the orbiting scroll **12** orbits with an orbiting radius e' shown in FIG. **3**.

According to the above-described configuration, the pair of main bearing-side keyways **51***a* provided in the back surface of the main bearing member **51** are located at positions escaping from a thrust support **51***b* provided centers thereof. Therefore, a sliding length p' (see FIG. **3**) of the main bearing-side keyway **51***a* can be made long as compared with a case where the main bearing-side keyway **51***a* is provided on the diameter line Y of the main bearing member **51**. A width O of the ring portion **57***a* of the Oldham ring **57** can be made small as compared with a case where the main bearing-side key **57***c* is provided on the diameter line Y of the ring portion **57***a* and the scroll-side key **57***b* is provided on the diameter line X of the ring portion **57***a*. As a result, since the outer diameter of the ring portion **57***a* can be made small, the compressing mechanism **4** can be made compact.

If the orbiting radius e' becomes large, an outer diameter $\phi n'$ (see FIG. **3**) of the envelope circle of the seal member **24** at the back surface of the panel **12***a* becomes large. However, since the pair of scroll-side keyways **12***d* are located at positions deviated from each other from the diameter line X of the panel **12***a*, the scroll-side keyways **12***d* do not interfere with the envelope circle having the outer diameter $\phi n'$, and sealing performance is not deteriorated. Thus, the orbiting radius e' can be designed large.

The scroll-side keys **57***b* and the main bearing-side keys **57***c* of the Oldham ring **57** may be formed from members different from that of the ring portion **57***a*, and the individu-

ally molded pair of scroll-side keys **57***b* and pair of main bearing-side keys **57***c* may be assembled and fixed to the ring portion **57***a*.

In this case, the ring portion **57***a* is provided with concave portions, and the scroll-side keys **57***b* and the main bearing-side keys **57***c* are provided with convex portions. The convex portions of the scroll-side keys **57***b* and the main bearing-side keys **57***c* are assembled and fixed to the concave portions of the ring portion **57***a* by a method such as press-fitting and shrink-fitting.

By forming the scroll-side keys **57***b* and the main bearing-side keys **57***c* from the members different from that of the ring portion **57***a*, it is possible to reduce weight and cost by employing light and inexpensive material for the ring portion **57***a*. If material having excellent sliding performance and having excellent compatibility with the scroll-side keyways **12***d* and the main bearing-side keyways **51***a* is employed for the scroll-side keys **57***b* and the main bearing-side keys **57***c*, reliability is enhanced.

SECOND EMBODIMENT

FIG. **4** is a plan view of an Oldham ring of a second embodiment of the invention. Since configurations other than that of the Oldham ring are the same as those of the first embodiment, explanation thereof will be omitted.

Side surfaces of the pair of scroll-side keys **57***b* include sliding surfaces **57***bx* which slide with the scroll-side keyways **12***d*, and non-sliding surfaces **57***by* which do not slide with the scroll-side keyways **12***d*.

Side surfaces of the pair of main bearing-side keys **57***c* include sliding surfaces **57***cx* which slide with the main bearing-side keyways **51***a*, and non-sliding surfaces **57***cy* which do not slide with the main bearing-side keyways **51***a*.

In the embodiment, the sliding surfaces **57***bx* and **57***cx* as well as the non-sliding surfaces **57***by* and **57***cy* have the same shapes, and all of vertical and lateral lengths of the four side surfaces and R-shapes of corner portions have the same shapes.

According to this, it becomes easy to machine the four side surfaces of the scroll-side keys **57***b* and the main bearing-side keys **57***c*, and the productivity is enhanced.

When the individually molded pair of scroll-side keys **57***b* and pair off main bearing-side keys **57***c* are assembled and fixed to the ring portion **57***a*, since the shapes of the four side surfaces are the same and they do not have directional properties, errors in an assembling operation can be eliminated and the productivity is enhanced.

THIRD EMBODIMENT

FIG. **5** is a plan view of an Oldham ring of a third embodiment of the invention. Since configurations other than those of the Oldham ring are the same as those of the first embodiment, explanation thereof will be omitted.

In this embodiment, the scroll-side keys **57***b* and the main bearing-side keys **57***c* are disposed on the ring portion **57***a* such that a line segment which connects center points of the pair of scroll-side keys **57***b* and a line segment which connects center points of the pair of main bearing-side keys **57***c* intersect with each other at right angles at the center of the ring portion **57***a*.

According to this, the scroll-side keys **57***b* and the main bearing-side keys **57***c* are disposed symmetrically with respect to the center of the ring portion **57***a*, a front surface and a back surface of the Oldham ring **57** have the same shapes, circumferential directions thereof are also symmetric 180° and thus, the assembling errors are eliminated and the productivity is enhanced.

FOURTH EMBODIMENT

FIG. **6**(*a*) is a plan view of an Oldham ring of a scroll compressor of a fourth embodiment as viewed from a fixed scroll. FIG. **6**(*b*) is a plan view of a main bearing member of the scroll compressor of the fourth embodiment as viewed from the fixed scroll. FIG. **6**(*c*) is a plan view of an orbiting scroll of the scroll compressor of the fourth embodiment as viewed from a back surface of a panel.

FIG. **7** is a plan view of a combination of the Oldham ring and the main bearing member of the fourth embodiment as viewed from the fixed scroll, and the orbiting scroll, the panel and the keyways are shown by dotted lines. An envelope circle at which a seal member disposed on the main bearing member comes into contact with the back surface of the panel is shown by a phantom line. Sine configurations other than that of the Oldham ring are the same as those of the first embodiment, explanation thereof will be omitted.

As shown in FIG. **6**(*a*), the Oldham ring **57** includes a ring portion **57***a* which is formed into a ring shape, a pair of scroll-side keys **57***b* provided on one of surfaces of the ring portion **57***a*, and a pair of main bearing-side keys **57***c* provided on the other surface of the ring portion **57***a*.

As shown in FIG. **6**(*b*), main bearing-side keyways **51***a* with which the main bearing-side keys **57***c* slide are provided in the back surface of the main bearing member **51**. The main bearing-side keys **57***c* are slidably fitted into the main bearing-side keyways **51***a*.

As shown in FIG. **6**(*c*), scroll-side keyways **12***d* with which the scroll-side keys **57***b* slide are provided in the back surface of the panel **12***a* of the orbiting scroll **12**. The scroll-side keys **57***b* are slidably fitted into the scroll-side keyways **12***d*.

A sliding direction of the scroll-side keys **57***b* in the scroll-side keyways **12***d* and a sliding direction of the main bearing-side keys **57***c* in the main bearing-side keyways **51***a* intersect with each other at right angles.

The pair of scroll-side keys **57***b* are disposed at locations deviated from each other from a diameter line X of the ring portion **57***a*. A distance La between the pair of scroll-side keys **57***b* is not less than a width Ma of the scroll-side keyway **12***d* or not less than a width Na of the scroll-side key **57***b*.

The pair of main bearing-side keys **57***c* are disposed at locations deviated from each other from a diameter line Y of the ring portion **57***a*. A distance Lb between the pair of main bearing-side keys **57***c* is not less than a width Mb of the main bearing-side keyway **51***a* or not less than a width Nb of the main bearing-side key **57***c*.

The scroll-side keys **57***b* and the main bearing-side keys **57***c* are disposed such that they do not project from an outer diameter of the ring portion **57***a* and they do not project from an inner diameter of the ring portion **57***a*. Therefore, it is unnecessary to provide a release portion in the vicinity of the main bearing-side keyway **51***a* of the main bearing member **51** for avoiding interference with respect to the main bearing-side key **57***c*. A shape in the vicinity of the key of a mold which manufactures a raw material of the Oldham ring **57** is simplified and thus, a life span is increased, and a lathe can be used for machining inner and outer peripheral surfaces of the ring portion **57***a*. Therefore, productivity is enhanced, strengths of root portions of the scroll-side keys **57***b* and the main bearing-side keys **57***c* are enhanced and reliability is enhanced.

Sliding surfaces which are side surfaces of each of the pair of scroll-side keys **57***b* and which slide with the scroll-side keyways **12***d* include a load-side sliding surface **57***bxw* which receives a load depending upon a rotation direction of the crankshaft **14** and a non-load-side sliding surface **57***bxu* which does not receive a load depending upon the rotation direction of the crankshaft **14**.

Sliding surfaces which are side surfaces of each of the pair of main bearing-side keys **57***c* and which slide with the main bearing-side keyways **51***a* include a load-side sliding surface **57***cxw* which receives a load depending upon the rotation direction of the crankshaft **14** and a non-load-side sliding surface **57***cxu* which does not receive a load depending upon the rotation direction of the crankshaft **14**.

Here, the crankshaft **14** rotates in a direction of the arrow in FIG. **6**(*b*), i.e., in a counterclockwise direction when the main bearing member **51** is viewed from the fixed scroll **11**.

In this embodiment, areas of the non-load-side sliding surfaces **57***bxu* and **57***cxu* are set smaller than areas of the load-side sliding surfaces **57***bxw* and **57***cxw*.

According to the embodiment, since the areas of the non-load-side sliding surfaces **57***bxu* and **57***cxu* are set smaller than the areas of the load-side sliding surfaces **57***bxw* and **57***cxw*, the width O of the ring portion **57***a* of the Oldham ring **57** can be made small and an outer diameter of the Oldham ring **57** can be made small.

In the embodiment, the areas of the non-load-side sliding surfaces **57***bxu* and **57***cxu* are not less than halves of the areas of the load-side sliding surfaces **57***bxw* and **57***cxw*.

According to the embodiment, since the areas of the non-load-side sliding surfaces **57***bxu* and **57***cxu* are not less than halves of the areas of the load-side sliding surfaces **57***bxw* and **57***cxw*, even in an unstable operation state immediately after start of operation, or in a transitory state or when the compressor is at rest, although gaps are generated between the scroll-side keys **57***b* and the scroll-side keyways **12***d* or between the main bearing-side keys **57***c* and the main bearing-side keyways **51***a*, backlash is suppressed, the compressor can be operated stably and the reliability is enhanced.

In this embodiment also, the scroll-side keys **57***b* and the main bearing-side keys **57***c* of the Oldham ring **57** may be formed from members different from that of the ring portion **57***a*, and the individually molded pair of scroll-side keys **57***b* and pair of main bearing-side keys **57***c* may be assembled and fixed to the ring portion **57***a*.

In this case, the ring portion **57***a* is provided with concave portions, and the scroll-side keys **57***b* and the main bearing-side keys **57***c* are provided with convex portions. The convex portions of the scroll-side keys **57***b* and the main bearing-side keys **57***c* are assembled and fixed to the concave portions of the ring portion **57***a* by a method such as press-fitting and shrink-fitting.

By forming the scroll-side keys **57***b* and the main bearing-side keys **57***c* from the members different from that of the ring portion **57***a*, it is possible to reduce weight and cost by employing light and inexpensive material for the ring portion **57***a*. If material having excellent sliding performance and having excellent compatibility with the scroll-side keyways **12***d* and the main bearing-side keyways **51***a* is employed for the scroll-side keys **57***b* and the main bearing-side keys **57***c*, reliability is enhanced.

FIFTH EMBODIMENT

FIG. **8**(*a*) is a plan view of an Oldham ring of a scroll compressor of a fifth embodiment as viewed from a fixed scroll. FIG. **8**(*b*) is a plan view of a main bearing member of the scroll compressor of the fifth embodiment as viewed from the fixed scroll. FIG. **8**(*c*) is a plan view of an orbiting scroll of the scroll, compressor of the fifth embodiment as viewed from a back surface of a panel.

FIGS. **9**(*a*) to **9**(*d*) are sectional views of essential portions of a combination of the Oldham ring and the orbiting scroll of the fifth embodiment as viewed from the fixed scroll.

As shown in FIG. **8**(*a*), the Oldham ring **57** includes a ring portion **57***a* which is formed into a ring shape, a pair of scroll-side keys **57***b* provided on one of surfaces of the ring portion **57***a*, and a pair of main bearing-side keys **57***c* provided on the other surface of the ring portion **57***a*.

As shown in FIG. **8**(*b*), main bearing-side keyways **51***a* with which the main bearing-side keys **57***c* slide are provided in the back surface of the main bearing member **51**. The main bearing-side keys **57***c* are slidably fitted into the main bearing-side keyways **51***a*.

As shown in FIG. **8**(*c*), scroll-side keyways **12***d* with which the scroll-side keys **57***b* slide are provided in the back surface of the panel **12***a* of the orbiting scroll **12**. The scroll-side keys **57***b* are slidably fitted into the scroll-side keyways **12***d*.

A sliding direction of the scroll-side keys **57***b* in the scroll-side keyways **12***d* and a sliding direction of the main bearing-side keys **57***c* in the main bearing-side keyways **51***a* intersect with each other at right angles.

The pair of scroll-side keys **57***b* are disposed at locations deviated from each other from a diameter line X of the ring portion **57***a*. A distance La between the pair of scroll-side keys **57***b* is not less than a width Ma of the scroll-side keyway **12***d* or not less than a width Na of the scroll-side key **57***b*.

The pair of main bearing-side keys **57***c* are disposed at locations deviated from each other from a diameter line **7** of the ring portion **57***a*. A distance Lb between the pair of main bearing-side keys **57***c* is not less than a width Mb of the main bearing-side keyway **51***a* or not less than a width Nb of the main bearing-side key **57***c*.

The scroll-side keys **57***b* and the main bearing-side keys **57***c* are disposed such that they do not project from an outer diameter of the ring portion **57***a* and they do not project from an inner diameter of the ring portion **57***a*. Therefore, it is unnecessary to provide a release portion in the vicinity of the main bearing-side keyway **51***a* of the main bearing member **51** for avoiding interference with respect to the main bearing-side key **57***c*. A shape in the vicinity of the key of a mold which manufactures a raw material of the Oldham ring **57** is simplified and thus, a life span is increased, and a lathe can be used for machining inner and outer peripheral surfaces of the ring portion **57***a*. Therefore, productivity is enhanced, strengths of root portions of the scroll-side keys **57***b* and the main bearing-side keys **57***c* are enhanced and reliability is enhanced.

Sliding surfaces which are side surfaces of each of the pair of scroll-side keys **57***b* and which slide with the scroll-side keyways **12***d* include a load-side sliding surface **57***bxw* which receives a load depending upon the rotation direction of the crankshaft **14** and a non-load-side sliding surface **57***bxu* which does not receive a load depending upon the rotation direction of the crankshaft **14**.

Here, the crankshaft **14** rotates in a direction of the arrow in FIG. **8**(*b*), i.e., in a counterclockwise direction when the main bearing member **51** is viewed from the fixed scroll **11**.

In this embodiment, the non-load-side sliding surface **57***bxu* projects outward from the scroll-side keyway **12***d*, and the load-side sliding surface **57***bxw* does not project outward from the scroll-side keyway **12***d*.

Here, a projecting area of the non-load-side sliding surface **57***bxu* which projects outward from the scroll-side keyway **12***d* is not more than half of the entire area of the load-side sliding surface **57***bxw*.

In a state shown in FIG. **9**(*b*), the non-load-side sliding surface **57***bxu* of one of the scroll-side keys **57***b* projects outward from the scroll-side keyway **12***d*. In a state shown in FIG. **9**(*d*), the non-load-side sliding surface **57***bxu* of the other scroll-side key **57***b* projects outward from the scroll-side keyway **12***d*.

According to this embodiment, when the compressor is stable, the non-load-side sliding surface **57***bxu* of the scroll-side key **57***b* does not receive a force. Therefore, even if the non-load-side sliding surface **57***bxu* projects from the outer diameter of the orbiting scroll **12** one time per one rotation, orbiting motion and compressing motion are not influenced, and the outer diameter of the orbiting scroll **12** can be made small by the projecting amount. Hence, the compressing mechanism **4** can be made compact, and it is possible to design the compressing mechanism **4** such that the orbiting radius is increased in size.

According to the embodiment, since the projecting area of the non-load-side sliding surface **57***bxu* is not more than half of the entire area of the load-side sliding surface **57***bxw* and according to this, the area of the non-load-side sliding surface **57***bxu* is set to not less than the half of the area of the load-side sliding surface **57***bxw*. Therefore, even in an unstable operation state immediately after start of operation, or in a transitory state or when the compressor is at rest, backlash generated by the gap of the scroll-side key **57***b* is suppressed, the compressor can be operated stably and the reliability is enhanced.

In this embodiment also, the scroll-side keys **57***b* and the main bearing-side keys **57***c* of the Oldham ring **57** may be formed from members different from that of the ring portion **57***a*, and the individually molded pair of scroll-side keys **57***b* and pair of main bearing-side keys **57***c* may be assembled and fixed to the ring portion **57***a*.

In this case, the ring portion **57***a* is provided with concave portions, and the scroll-side keys **57***b* and the main bearing-side keys **57***c* are provided with convex portions. The convex portions of the scroll-side keys **57***b* and the main bearing-side keys **57***c* are assembled and fixed to the concave portions of the ring portion **57***a* by a method such as press-fitting and shrink-fitting.

By forming the scroll-side keys **57***b* and the main bearing-side keys **57***c* from the members different from that of the ring portion **57***a*, it is possible to reduce weight and cost by employing light and inexpensive material for the ring portion **57***a*. If material having excellent sliding performance and having excellent compatibility with the scroll-side keyways **12***d* and the main bearing-side keyways **51***a* is employed for the scroll-side keys **57***b* and the main bearing-side keys **57***c*, reliability is enhanced.

The ring portion **57***a* of the Oldham ring **57** may be a long circular ring-shape having two arcs connected to each other through straight portions.

INDUSTRIAL APPLICABILITY

As described above, according to the scroll compressor of the present invention, since the outer diameter of the Oldham ring can be made small, it is possible to reduce the compressing mechanism in size, and it is possible to design the compressing mechanism such that the orbiting radius is further increased in size. Therefore, the invention can be applied to an air scroll compressor, a vacuum pump and a scroll fluid machine such as a scroll expansion machine without limiting working fluid to the refrigerant.

The invention claimed is:

1. A scroll compressor comprising a compressing mechanism, in which the compressing mechanism comprises:
- a crankshaft including an eccentric shaft,
- a main bearing member which rotatably supports the crankshaft,
- an orbiting scroll which is rotatably fitted to the eccentric shaft,
- a fixed scroll which meshes with the orbiting scroll to form a compression space, and
- an Oldham ring which prevents the orbiting scroll from rotating, the Oldham ring comprises:
- a ring-shaped ring portion,
- a pair of scroll-side keys, each having sliding contact surfaces on its side surfaces, provided on one surface of the ring portion, and
- a pair of main bearing-side keys, each having sliding contact surfaces on its side surfaces, provided on the other of the surfaces of the ring portion, wherein
- the orbiting scroll is provided with scroll-side keyways across which the sliding contact surfaces of the scroll-side keys slide,
- the main bearing member is provided with main bearing-side keyways across which the sliding contact surfaces of the main bearing-side keys slide,
- a sliding direction of the scroll-side keys in the scroll-side keyways and a sliding direction of the main bearing-side keys in the main bearing-side keyways intersect with each other at right angles,
- the pair of scroll-side keys are disposed at locations deviated from each other from a diameter line of the ring portion so that a distance between the pair of scroll-side keys becomes equal to or greater than a width of the scroll-side keyway,
- the pair of main bearing-side keys are disposed at locations deviated from each other from the diameter line of the ring portion so that a distance between the pair of main bearing-side keys becomes equal to or greater than a width of the main bearing-side keyway,
- the sliding contact surfaces of the pair of scroll-side keys comprise:
  - load-side sliding contact surfaces of the scroll-side keys that receive loads during rotation of the crankshaft, and
  - non-load-side sliding contact surfaces of the scroll-side keys that do not receive loads during the rotation of the crankshaft, and
- when one of the scroll-side keys is at the farthest position from a center of the orbiting scroll, a part of the non-load-side sliding contact surface of the one of the scroll-side keys projects from the scroll-side keyway, and the load-side sliding contact surface of the one of the scroll-side keys does not project from the scroll-side keyway.

2. The scroll compressor according to claim **1**, wherein the scroll-side key and the main bearing-side key do not project from an outer diameter of the ring portion, and do not project from an inner diameter of the ring portion.

3. The scroll compressor according to claim **1**, wherein the sliding contact surfaces of the main bearing-side keys include
- load-side sliding contact surfaces of the main bearing-side keys that receive loads during a rotation of the crankshaft, and
- non-load-side sliding contact surfaces of the main bearing-side keys that do not receive loads during the rotation of the crankshaft, and

an area of the non-load-side sliding contact surface of the main bearing-side keys is smaller than an area of the load-side sliding contact surface of the main bearing-side keys.

4. The scroll compressor according to claim **3**, wherein the area of the non-load-side sliding contact surface of the main bearing-side key is not less than half of the area of the load-side sliding contact surface of the main bearing-side key.

5. The scroll compressor according to claim **1**, wherein a projecting area of the non-load-side sliding contact surface of the one of the scroll-side keys projecting from the scroll-side keyway is not more than half of an entire area of the load-side sliding contact surface of the one of the scroll-side keys.

6. The scroll compressor according to claim **1**, wherein the pair of scroll-side keys and the pair of main bearing-side keys are formed by individual molding, and they are assembled and fixed to the ring portion.

7. The scroll compressor according to claim **1**, wherein a line segment which connects centers of the pair of scroll-side keys with each other and a line segment which connects centers of the pair of main bearing-side keys intersect with each other at right angles at a center of the ring portion.

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